Multispectral Polarization of Eight Lunar Soils: Results from Spectral Measurements and Radiative Transfer Modeling. Lingzhi Sun[1,2], Paul G. Lucey[2], Casey I. Honniball[1,2], Macey Sandford[1,2], Emily S. Costello[1,2], Liliane Burkhard[2], Reilly Brennan[3], Chiara Ferrari-Wong[4], Anthony Colaprete[5], [1]Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, HI, USA, lucey@higp.hawaii.edu; [2]Dept. of Geology and Geophysics, University of Hawaii, Honolulu, HI, USA; [3]Dept. of Chemistry, University of Hawaii, Honolulu, HI, USA, [4]Columbia University, New York NY USA; [5] NASA Ames Research Center, Moffatt Field CA USA.

Introduction: Polarization is a fundamental property of light that can provide new insight into the surfaces of planetary objects. Separation of polarized components can shed light on the properties of grain surfaces, now known to be a critical aspect of space weathering, and the interior of grains that may contain more fundamental compositional information. Shkuratov and co-workers [1-4] have shown in a series of papers the unique contribution of polarization to lunar studies using laboratory measurements of lunar samples, lunar analog materials and telescopic observations of the Moon. Recently, Jeong et al. [5] reported extensive multispectral polarization telescopic observations, drawing conclusions regarding the differential effects of space weathering on the mare and highlands.

These advances led us to conduct imaging polarization measurements of a series of lunar soils for which we have extensive chemical and mineralogical analysis. The eight samples cover the entire range of lunar iron and titanium contents, and for each composition we include a very mature and a very immature sample. Our measurements were collected at a phase angle of 90 degrees, near the largest excursion of linear polarization [4].

Methods: We collected two types of data for this project: Multispectral imaging polarimetry in the visible portion of the spectrum in three wavelengths, 430, 656, and 750 nm, and polarization spectroscopy from 500 to 2500 nm.

Results and conclusions: We collected multispectral imaging and spectroscopic polarimetry of 8 lunar soils covering the major range of lunar surface composition and maturity. All soils exhibited polarization at all wavelengths.

Radiative transfer models are widely used in resolving the interaction of light and lunar soils. For future work, we will build a radiative transfer model based on the work of Hapke [6] for the polarized reflectance to investigate the relation between composition and maturity of lunar soil and degree of polarization.

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